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Modeling innovation diffusion patterns

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Chapter 3

An introduction to three empirical applications

In this short chapter we introduce the three empirical applications we carry out in this study. We also justify why we develop these models and their applications.

The applications that we present in the following sections are built on the traditional Bass model. The Bass model is the most parsimonious aggregated diffusion model suggested in marketing literature (Parker, 1994). The Bass model is the foundation for many articles in marketing because, since it was published, several hundred articles have been written (Mahajan, Muller and Bass, 1990, 1993; Mahajan, Muller and Wind, 2000) on the applications and extensions of the model (Sultan, Farley and Lehmann, 1990). Moreover, the Bass model has been the basis for the formulation of *empirical generalizations* in marketing (Bass, 1993, 1995). Despite this, it has its shortcomings because it is based on number of rather restrictive assumptions (see Section 2.4).

The assumptions of the Bass model mean that it lacks important details that do not allow the analyses of the diffusion process of certain innovations in certain situations. For example, an extended diffusion model is needed when researchers are interested in investigating the role of price in the diffusion process of electrical durable innovations. In this situation, researchers need a diffusion model that accounts for the effect of price. Furthermore, previous research has found that for this kind of innovation, the potential market varies with the number of households with electricity. Hence, the extended model should also incorporate a dynamic potential market to account for this fact. In this respect, research on relaxing some of the assumptions of the classical diffusion models helps new research to provide powerful tools for investigating the temporal diffusion process of any innovation in any situation. We proceed in this direction. The topics that we investigate address some of the shortcomings of the Bass model (see Table 3.1). The applications show different models and are applied in different contexts.

Diffusion of movies in neighboring Mediterranean countries (Chapter 4)

The present study has two objectives. First, we extend basic diffusion models to incorporate distribution into the models, which is a rarely incorporated marketing variable. Then, we analyze the *country* and *time effects* in the diffusion processes of a number of new products in different Mediterranean European countries. The analysis of these kinds of effects can reveal differences or likenesses in the diffusion patterns among countries, allowing managers to design appropriate (similar or different) marketing plans when they are thinking of commercializing the same innovation in those countries. Two well-known Bass-type models are used to incorporate distribution as a decision variable and some statistical tests and a regression analysis are developed to detect the *country* and the *time effects*. The empirical application is carried out on a group of new movies shown in Spain, France and Italy during the period 1997-1999.

The Bass model is based on nine assumptions, as has been discussed extensively in Chapter 2. In Chapter 4 we relax assumptions 2, 3 and 9, because:

- we allow the potential market to be dynamic. In our model we assume that distribution can affect the size of the potential market (assumption 2).
- we assume that the parameters of external and internal influence vary over the diffusion process of the innovation. More explicitly: we assume that distribution affects the adoption rate (assumption 3).
- we explicitly consider a marketing variable: distribution (assumption 9).

Although we consider different countries, we do not relax assumption 5. As with other authors (see Section 2.4.2.5), we use a diffusion model to analyze differences in the diffusion processes of the same group of innovations in different countries, but we do not incorporate any modification in the model to account for the specific characteristics of each geographical area. The analysis of distribution is very interesting given the relevance of this marketing variable in the commercialization of any product in the marketplace, and given the low number of diffusion studies that consider this marketing variable (see Section 2.4, Table 2.10). Furthermore, the analysis of movies in different Mediterranean countries (France, Italy and Spain) allows us to distinguish whether there are differences in the diffusion processes among these countries because of some specific country factors -“country effect”- and/or because of the moment of the product introduction in the market -“time effect”-.

Diffusion of franchising in Spain (Chapter 5)

In this study, we consider the diffusion of an organizational innovation, namely franchising, by firms in Spain during the period 1974-1999. We analyze the diffusion of franchising among firms as an organizational innovation from the point of view of the franchisors (i.e. inter-firm diffusion). The adoption of this system of commercialization has extreme consequences for the adopting

organization (the franchisor). We apply well known diffusion models to detect how many firms are influenced by firms that have adopted the franchising concept (“imitators”) and how many firms are not influenced by the timing of the adoption by other firms (“innovators”). We develop a four step approach to select the most appropriate diffusion model. After visual analysis of the data, we test whether the adoption follows a purely random process or whether firms imitate the adoption of the franchising concept. In the third step we compare some nested and non-nested models and the final selection is based on stability and predictive validation criteria.

Chapter 5 focuses on an organizational innovation, franchising; where the decision maker is not the consumer, but the firm. This chapter highlights the usefulness of diffusion models in analyzing diffusion processes of organizational innovations, which had been in doubt with the work of Mahajan, Sharma and Bettis (1988). We relax in this second application the first three assumptions of the Bass model. We relax assumption 1 and consider the possibility of a heterogeneous population of adopters through the incorporation of a new parameter into some of the models. We assume that the potential market depends on the number of Spanish firms available in the marketplace during the diffusion process of the innovation (assumption 2). And, assumption 3 is relaxed by considering a non-uniform parameter of internal influence in some of the diffusion models.

Diffusion of prescription drugs in the United States of America (Chapter 6)

In this study, we employ diffusion modeling to investigate longitudinal and cross-sectional effects of marketing expenditures on the diffusion of new pharmaceuticals. Although we focus on a certain product category characterized by a large number of introductions (new drugs) during the observational period, we also apply the same analyses to two other categories, one with close similar characteristics and another quite different to the previous category. We extend previous research on trial-repeat diffusion models by proposing a family of diffusion models that allows us: i) to accommodate own and competitors’ different marketing instruments, and ii) to detect the appropriate allocation for marketing instruments in the trial rate, instead of considering *a priori* that marketing instruments affect it through the external influence, as previous studies do. After selecting the most appropriate trial-repeat diffusion model, we investigate cross-sectional effects of marketing instruments on both the trial and the repeat rate of the diffusion processes of the new pharmaceutical products. The cross-sectional analysis allows us to study whether marketing expenditures both have an informative and persuasive influence on the diffusion processes. The empirical application is carried out by using US data on the “rhinitis”, “asthma” and “osteoarthritis-rheumatoid-arthritis” categories of prescription drugs in the observational period 1993-2000.

In Chapter 6 we address the diffusion of prescription drugs, i.e. the diffusion of frequently purchased consumer products. The lack of attention to model this kind of goods is due to the difficulty of both modeling repeat purchases and finding appropriate databases in which sales are divided into first and repeat purchases. Although we consider consumer products, it is not the consumers who are the decision makers but the doctors who prescribe the prescription drugs. In this chapter four assumptions behind the Bass model are relaxed. Assumption 3: we assume that marketing variables affect external and/on internal influence over the diffusion process. Assumption 4: we explicitly incorporate repeat purchases into the diffusion model. Assumption 6: we consider the effect of competitive variables on the diffusion process. Assumption 9: we incorporate marketing variables, such as detailing, medical journal advertising, physician meetings and direct-to-consumer advertising.

Table 3.1.
Characteristics of the empirical applications

	Chapter 4	Chapter 5	Chapter 6
Innovation	Entertainment and experience consumer products: Movies	Organizational: Franchising	Frequently purchased consumer product: Prescription drugs
Decision maker	Consumers	Firms	Doctors
Assumptions relaxed	<u>Assumption 2</u> Dynamic potential market <u>Assumption 3</u> Varying parameters of external and internal influence (using separable function) <u>Assumption 9</u> Marketing variables: distribution	<u>Assumption 1</u> Heterogeneous adopter population <u>Assumption 2</u> Dynamic potential market <u>Assumption 3</u> Varying parameter of internal influence (using non-separable function)	<u>Assumption 3</u> Varying parameter of external and/or internal influence (using separable and non-separable function) <u>Assumption 4</u> Repeat purchases <u>Assumption 6</u> Competition context <u>Assumption 9</u> Marketing variables: detailing, medical journal advertising, physician meetings, and direct-to-consumer advertising
Country	France, Italy and Spain	Spain	United States of America

In the chapter that follows the three applications addressed in the thesis, we summarize their contributions and we discuss the limitations of these models.

